

**REMARKS**

The Office Action mailed January 9, 2006, has been received and reviewed. Claim 27 is currently pending in the application. Claim 27 stands rejected. Applicants have amended claim 27 and added new claims 73-80. All claim amendments and additions are supported by the as-filed specification and no new matter was added. Reconsideration is respectfully requested.

**35 U.S.C. § 103(a) Obviousness Rejections**

**Obviousness Rejection Based on U.S. Patent No. 6,090,697 to Xing et al. in view of U.S Patent No. 5,633,200 to Hu**

Claim 27 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Xing et al. (U.S. Patent No. 6,090,697) in view of Hu (U.S. Patent No. 5,633,200). Applicants respectfully traverse this rejection, as hereinafter set forth.

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

Xing discloses a high-selectivity via etching process. The process includes forming a titanium silicide layer over doped polysilicon. (Xing, col. 10, lines 11-15). Ti-Al-N is then sputter deposited over the titanium silicide layer to create a Ti-Al-N barrier layer separated from the doped polysilicon by a titanium silicide layer. (Xing, col. 10, lines 21-29). Hu is cited for teaching a two-step method of forming a tungsten nitride layer. The method includes using PVD reactive sputtering to deposit a tungsten-rich tungsten nitride layer in a nitrogen environment. The reaction causes a thin tungsten film to be deposited which results in only minimal nitrogen deposition and no tungsten nitride grain growth. (Hu, col. 3, lines 43-61). Thereafter, grain

growth occurs by heating the tungsten film in a richer nitrogen environment at a temperature between 600°C and 700°C. (Hu, col. 4, lines 33-39).

By way of contrast with Xing and Hu, claim 27 of the presently claimed invention recites a “providing a substrate with an overlying insulating layer; etching a hole through the insulating layer to the substrate; introducing doped polycrystalline silicon into the hole; introducing at least one titanium layer within the hole over the doped polycrystalline silicon; introducing at least one non-titanium layer over the at least one titanium layer and within the hole; siliciding the titanium layer; nitridizing the non-titanium layer by exposing the non-titanium layer to a  $N_2/NH_3$  ambient at a temperature of about 360°C; and forming the semiconductor device over the non-titanium layer.” Support for the amendment may be found throughout the as-filed specification, for example, as-filed paragraph [0023]. Applicants respectfully submit that the proposed combination of references fail to teach or suggest each and every element of the presently claimed invention.

As acknowledged by the Examiner, Xing fails to teach or suggest forming a tungsten nitride layer by a process that includes nitridizing a metal layer. (Office Action, page 3). Applicants respectfully submit that Hu cannot correct this deficiency as Hu fails to teach or suggest “nitridizing the non-titanium layer by exposing the non-titanium layer to a  $N_2/NH_3$  ambient at a temperature of about 360°C” as recited in claim 27 of the presently claimed invention. Instead, Hu discloses a method wherein a tungsten film is heated in a nitrogen environment at a temperature of about 600-700°C. (Hu, col. 4, lines 33-39). Hu fails to teach or suggest that the nitrogen environment is  $N_2/NH_3$ . As the proposed combination of references fail to teach or suggest each and every element of the presently claimed invention, Applicants respectfully submit claim 27 of the presently claimed invention is not rendered obvious over Xing in view of Hu. Reconsideration and withdrawal of the rejection is requested.

Claims 73-80 are each allowable as depending, either directly or indirectly, from allowable claim 27.

Claim 73 is further allowable as the combination of Xing in view of Hu fails to teach or suggest exposing the the non-titanium layer to a  $N_2/NH_3$  ambient under a pressure of approximately 4.5 torr.

Claim 77 is further allowable as the combination of Xing in view of Hu fails to teach or suggest siliciding the titanium layer prior to depositing at least one non-titanium layer over a titanium layer.

Claim 78 is further allowable as the combination of Xing in view of Hu fails to teach or suggest selectively depositing the titanium layer on the polycrystalline silicon through chemical vapor deposition.

Claim 79 is further allowable as the combination of Xing in view of Hu fails to teach or suggest siliciding the titanium layer comprises exposing the semiconductor substrate to  $\text{TiCl}_4$  with a reactive gas and a carrier gas at a temperature about  $400^\circ\text{C}$  in a reaction chamber under a pressure of approximately 0.2 to 2 torr while an rf voltage is applied to the reaction chamber.

Claim 80 is further allowable as the combination of Xing in view of Hu fails to teach or suggest providing an oxidation barrier between the non-titanium layer and the semiconductor device.

#### **ENTRY OF AMENDMENTS**

The amendment to claim 27 above should be entered by the Examiner because the amendments are supported by the as-filed specification and drawings and do not add any new matter to the application.

**CONCLUSION**

Claims 27 and 73-80 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, the Examiner is respectfully invited to contact Applicants' undersigned attorney.

Respectfully submitted,



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